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(71) Applicant *(for all designated States except US)*: **DEEP VIDEO IMAGING LIMITED** [NZ/NZ]; Airport Road, Mystery Creek, RD 2, Hamilton 2001 (NZ).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: **ENGEL, Gabriel, Damon** [US/NZ]; 19A Rostrevor Street, Hamilton 2001 (NZ).

(74) Agents: **WILSON, Kathryn, Shelley** et al.; Private Bag 3140, Level 12, KPMG Centre, 85 Alexandra Street, Hamilton 2001 (NZ).

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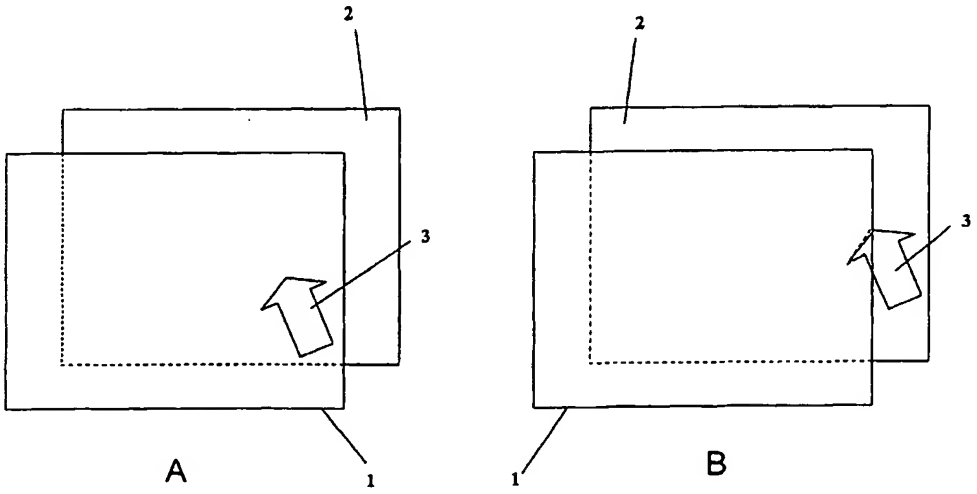
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONTROL OF DEPTH MOVEMENT BETWEEN SCREENS OF MULTILEVEL DISPLAY



(57) Abstract: A visual indicator such as a cursor (3) is moved between two or more screens (1, 2) of a multi-layered display system, via an input device. The input device can be a touch screen, where varying the degree of pressure applied to the touch screen determines on which screen the cursor is displayed. The plurality of screens (1, 2) may comprise liquid crystal displays, and provide a three dimensional depth effect.

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CONTROL OF DEPTH MOVEMENT BETWEEN SCREENS OF MULTILEVEL DISPLAY

TECHNICAL FIELD

This invention relates to a visual display system.

BACKGROUND ART

Particularly, the present invention relates to a visual display system including single level screens placed physically apart to form a multi-level screen.

Such screens are described in PCT Application Nos. PCT/NZ98/00098 and PCT/NZ99/00021.

These devices are created by combining layers of selectively transparent screens. Each screen is capable of showing an image. In preferred embodiments the screen layers are liquid crystal display. Preferably the screens are aligned parallel to each other with a pre-set distance between them.

With this device images displayed on the screen furthest from view (background screen) will appear at some distance behind the images displayed on the screen closer to the viewer (foreground screen). The transparent portions in the foreground screen will allow viewers to see images displayed on the background screen.

This arrangement utilising multiple screens allows images to be presented at multiple levels giving the viewer true depth without use of glass or lens.

Up until now, software has been written to create visual sequences on the multi-level screens. These sequences have been mainly passive, mainly for viewing rather than for interaction.

While the visual effect of these sequences is spectacular, it will be desirable if potential uses of a multi-level screen display could be explored further.

It is an object of the present invention to address this problem, or at least to provide the public with a useful choice.

Aspects of the present invention will now be described by way of example only with reference to the following description.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a visual display system including

at least two single level screens spaced physically apart to form a multi-level screen,

wherein each single level screen has a two-dimensional plane,

a visual indicator,

an input device,

a user selectable input,

the visual display system being characterised in that

the user can use the user selectable input to move the visual indicator via the input device out of the two-dimensional plane of a particular screen and on to another screen.

According to another aspect of the present invention there is provided a method of using a visual display system which has at least two multi-level screens spaced physically apart,

wherein each screen has a two-dimensional plane,

the visual display system also including

a visual indicator,

an input device,

a user selectable input,

the method characterised by the step of

the user using the selectable input to move the visual indicator out of the two-dimensional plane of a particular screen and on to another screen.

In one aspect of the present invention there is provided media containing instructions for the operation of visual display system as described.

In preferred embodiments of the present invention the multi-level screens are similar to that described in PCT Application Nos. PCT/NZ98/00098 and PCT/NZ99/00021, although this should not be seen as limiting.

The term two-dimensional plane refers to the effective viewing plane on a particular screen, similar to that seen on a normal display screen.

The visual indicator may be any type of indicator, for example a cursor, image, icon or screen image. It is envisaged that the visual indicator is something which can move in response to the user of the system via some input mechanism.

The input device may be any suitable input device, for example a mouse, tablet data glove, keyboard, touch screen, joystick, trackball, pen, stylus, touch pad, voice and so forth.

The user selectable input is preferably an input the user can make to effect the operation of software running the display device via the input device.

For example, if the input device is a mouse, then the user selectable input may be a mouse button. If the input device is a joystick, then the user selectable input may be

the trigger. If the user input is a keyboard, then the user selectable input may be arrow keys. And so forth.

We envisage that the present invention could be used extensively by those in the graphics industry. Therefore one embodiment in the present invention is envisaged that by having the input device as a pen or stylus, the present invention could be utilised in these industries to its fullest.

In some embodiments, the user selectable input may actually be a software button on a touch screen that may be independent of the input device. This allows standard input devices and drivers to be used without modification.

In some embodiments of the present invention, the input device shall be a mouse and the user selectable input is a mouse button. The mouse button may be an existing button on the mouse, or in some embodiments may be a dedicated button for use with the present invention.

This should not be seen as limiting.

In preferred embodiments of the present invention, the input device is a finger of the user or a stylus. The user selectable input is actually the pressure applied by the user to a touch screen.

The touch screen may be any type of screen which allows direct user interaction with the screen to affect the display. For example, the touch screen may be capacative, optical or acoustic, or any other technology which achieves the desired user interface.

The visual indicator shall now be referred to as a cursor, although this should not be seen as limiting.

The user can lightly press their finger on a touch screen to move a cursor around the display touch screen as can be achieved with usual software. However, with one

embodiment of the present invention, the user can apply greater pressure on the touch screen to cause the visual indicator to move from one screen to another screen.

While in some embodiments the means by which the user can move the cursor from one screen to the other may not be pressure (for example, a double tap), this is the preferred embodiment.

In some embodiments, the actual amount of pressure required to move the cursor from one screen to the other may be variable and chosen by the user. For example, there may be provided a scroll bar which enables the user to increase or decrease the effective pressure required to move the cursor. Ideally, the amount of pressure should be such that a light pressure on the screen enables a user to easily move the cursor on one screen without worrying about slight variations in pressure causing the cursor to go up to the other screen. However, the pressure required should not be so strong as it is uncomfortable for the user or the physical configuration of the screen.

In a preferred embodiment, the touch pressure data consists of a number between 0 and 255 which is stored in an accessible register and constantly updated by touch screen drivers. The relationship between the number and the actual physical pressure in Pascals is part of software for a commercial touch screen driver. However as an example, a light touch can give a reading of around 30-50 units while a firmer one around 180-220. A likely threshold to cause the cursor to jump screens could be in the order of 175 or so units. This can correspond to a deliberate but not finger destroying push to make it happen.

In one embodiment there may be included an auto calibration system. A persons first touch can be measured and used as a basis or system reference for what the persons normal touch pressure was. For the threshold pressure to jump screens can then be determined as a set percentage higher than this.

An alternate application of the present invention can include a "ring of light" around

a screen icon. This can make the icon glow more as you pushed harder. For example, there could be four ranges of touch pressure which resulted in four levels of light intensity being displayed. At a certain intensity then the cursor can jump from once screen to another.

Suitable software to implement the above embodiment is Macromedia TM Director.

Depending on the environment, greater or lesser pressures may be required to move the cursor from one screen to another.

In a preferred embodiment the software controlling the cursor position is supplemental to usual touch screen driver software.

In a preferred embodiment the present invention the touch screen driver software used is ELO Touchsystems Touchscreen Drivers Distribution Win9xRc8.zip. This contains touch screen drivers 03.00.00 and has control panel MonMouse.cpl version 3.08RC8.

Therefore a program can run as usual with standard mouse drive commands but the cursor position between screens can change as a consequence of the interaction of the supplemental program responding to the additional pressure from the user.

This ability enables the user to actually interact with different screens and work on separate screens at the touch of a finger and can readily interact with whichever screen has been selected. The advantages of this feature are self apparent.

In some embodiments, the movement from the two-dimensional plane of one screen to another screen may be discrete and it may appear that the visual indicator merely jumps from one screen to the other and be at the same x-y coordinate with the only change being in the z axis.

In other embodiments, there may be more of a linear movement perceived as a

consequence of the movement from one screen to the other.

For example, the present invention may be used in conjunction with a drawing package. The person drawing may start drawing on the front screen of the visual device using their finger as an input device.

The person then may wish to take advantage of the three dimensional quality allowed by the present invention and effectively draw in the z axis (the x and y axis having already been drawn in on the two-dimensional screen). This may be achieved by the user pressing on the screen and dragging the cursor effectively so it appears to pass from one screen to the other screen with an image (say a line) appearing to provide a visual bridge between the front screen and another screen or screens in the background.

In other embodiments of the present invention this ability may be used with particular total screen images. For example, the present invention may be used with an interactive game which gives the impression that the user is moving deep within a scene. For example, the user may be flying a craft in the game and as the user moves forward in the game, the images may pass from the background screen or screens to the foreground screen giving the illusion of full movement. In this embodiment the visual indicator may be the images and the input device a joy-stick.

Aspects of the present invention will now be described with reference to the following drawings which are given by way of example only.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figure 1 illustrates one embodiment of the present invention, and

Figure 2 illustrates a second embodiment of the present invention, and

Figure 3 illustrates a third embodiment of the present invention.

BEST MODES FOR CARRYING OUT THE INVENTION

Figures 1a and 1b illustrate a stylised version of one embodiment of the present invention at work. These figures have foreground screens 1 and background screens 2.

It should be appreciated that the reference to just two screens is by way of example only and the present invention may work in relation to multiple numbers of screens.

Figure 1a shows the positioning of the visual indicator 3 in the form of a cursor arrow on the front foreground screen 1.

In this embodiment of the present invention a simple push of a finger or stylus causes the cursor 3 to appear in exactly the same x-y coordinates as on the foreground screen one, but, positioned on the background screen 2.

Thus in this embodiment, the user does a direct transpose in the z-axis between screens.

Figure 2 likewise has a foreground screen 1 and a background screen 2. In Figure 2a, a triangle 4 has been drawn on the x-y two-dimensional plane of the foreground screen 1.

In Figure 2b, to give the triangle 4 depth, the user has selected and dragged the image in the x y direction to give not only the image of a triangle 5 on the background screen 2, but also a plane in the z axis 6 for finding a solid-looking representation. As the screens are physically quite separate, the illusion of the solid wall 6 is accomplished by sophisticated software shading techniques.

Figure 3 again has a foreground screen 1 and background screen 2.

This embodiment of the present invention can be used for moving through three-dimensional landscapes. For example, in Figure 3a, there is pictured a flower 7 on the foreground screen, tree 8 along with a cloud 9 are positioned on the background screen 2.

The user may then use their finger or stylus to effectively move through the scene visually. This causes the flower depicted in Figure 3a to disappear from the foreground screen as shown in Figure 3b. This also causes the tree 8 to move from the background screen 2 to the foreground screen 1. The cloud 9 being in the far background stays on the background screen 2.

Thus it can be seen that the present invention allows considerable amount of interaction between the user and the screens.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope of the appended claims.

WE CLAIM:

1. A visual display system including

at least two single level screens spaced physically apart, to form a multi level screen

wherein each single level screen has a two-dimensional plane,

a visual indicator,

an input device,

a user selectable input,

the visual display system being characterised in that,

the user can use the user selectable input to move the visual indicator via the input device out of the two-dimensional plane of a particular screen and onto another screen.

2. A visual display system as claimed in claim 1 which is based on LCD technology.

3. A visual display system as claimed in either claim 1 or claim 2 wherein the visual indicator moves in response to the user of the system by a input mechanism.

4. A visual display system as claimed in any one of claims 1 to 3 wherein the visual indicator is a cursor.

5. A visual display system as claimed in any one of claims 1 to 4 wherein the input device is any one of the group including a mouse, tablet, data glove, keyboard, touch screen, joystick, trackball, pen, stylus, touch pad or voice.

6. A visual display as claimed in any one of claims 1 to 5 wherein the input device is a touch screen.

7. A visual display system as claimed in any one of claims 1 to 6 wherein the user selectable input is the pressure applied to a touch screen.

8. A visual display as claimed in claim 7 wherein the amount of pressure required to move the visual indicator from one screen to the other is variable and chosen by the user.

9. A visual display as claimed in any one of claims 1 to 8 wherein the software controlling the visual indicator position is supplemental to usual touch screen driver software.

10. A visual display as claimed in any one of claims 1 to 9 wherein the movement of the visual indicator from one screen to the other is at the same XY co-ordinate with only a change shown in the Z axis.

11. A visual display as claimed in any one of claims 1 to 9 wherein the movement of the visual indicator is perceived as linear between one screen and the other.

12. A method of using a visual display system which has at least two multi level screens spaced physically apart,

wherein each screen has a two dimensional plane,

the visual display system also including

a visual indicator,

an input device,

a user selectable input,

this method characterised by the step of

a) the user using the selectable input to move the visual indicator out of the two-dimensional plane of a particular screen and onto another screen.

13. A media containing instructions for the operation of a visual display system as claimed in any one of claims 1 to 11.

14. A visual display system substantially as herein described with reference to and as illustrated by the accompanying drawings.

15. A method substantially as herein described with reference to and as illustrated by the accompanying drawings.

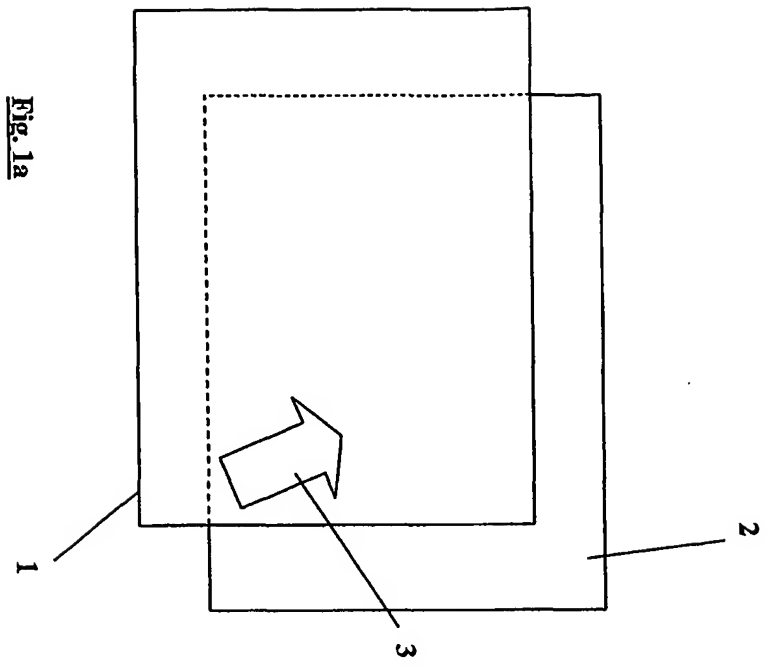

Fig. 1a

Fig. 1

1/3

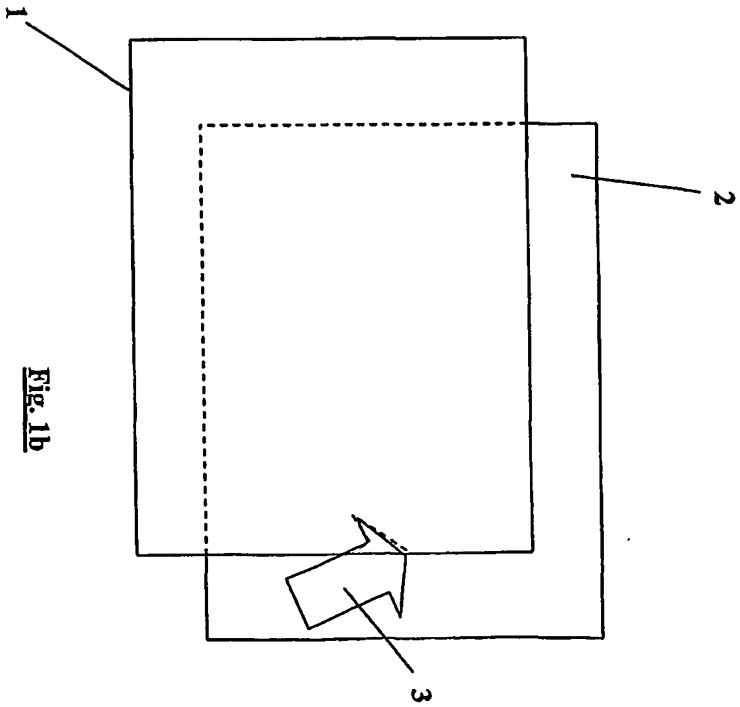

Fig. 1b

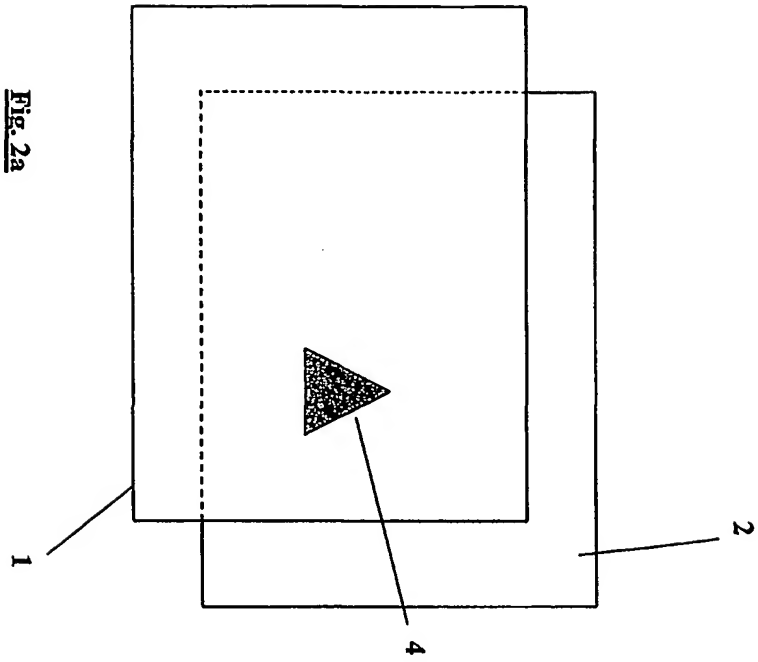

Fig. 2a

2/3

Fig. 2

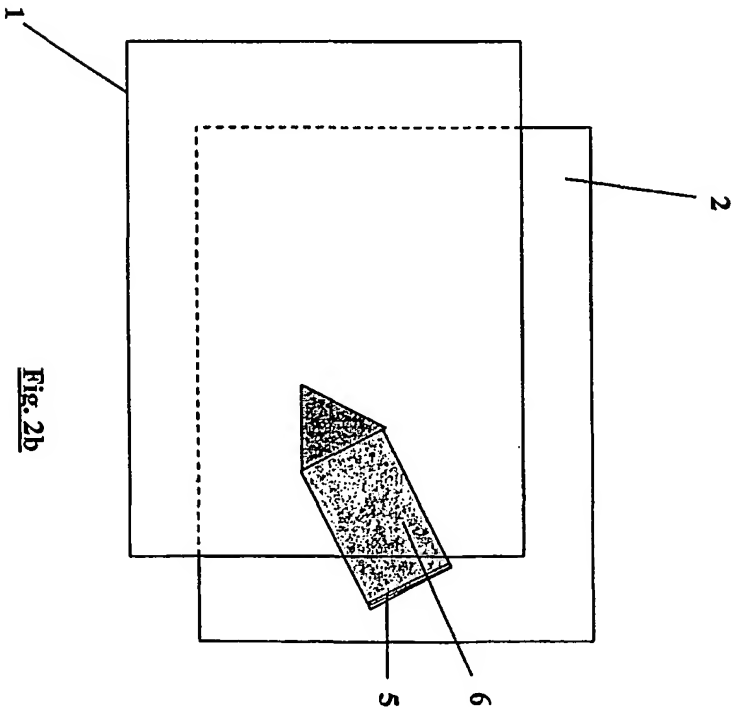

Fig. 2b

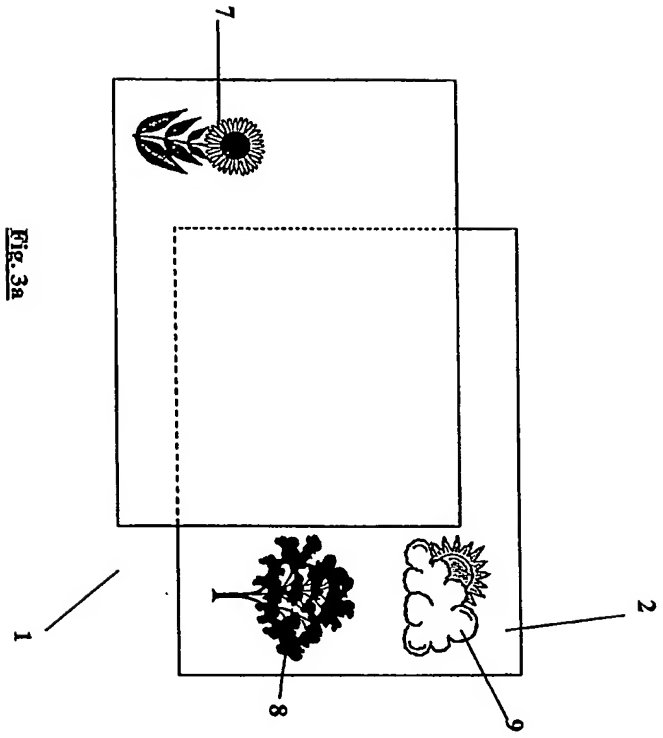

Fig.3a

Fig.3

3/3

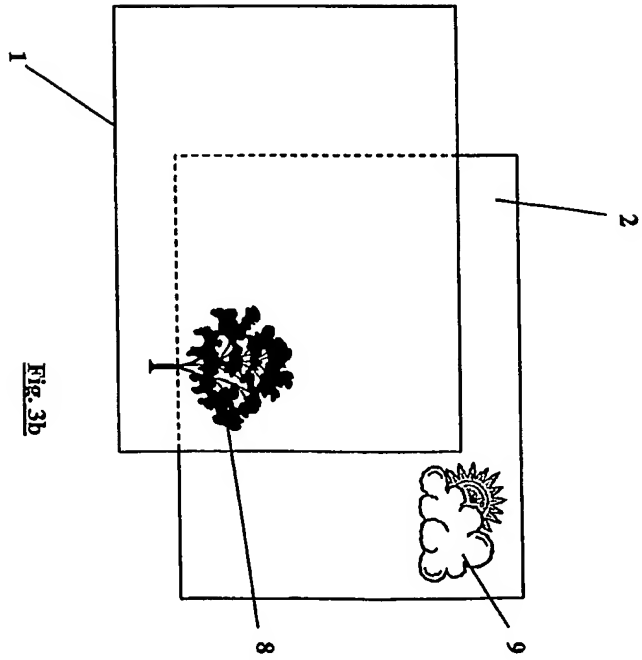

Fig.3b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NZ02/00059

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: G09G 5/08, G06F 3/033, G02B 27/22,

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI, JAPIO with Keywords: multilevel, multilayer, 3d, three dimens, depth, G02B 27/22; screen; cursor, icon, pointer, icon, visual indicator; touch, pressure sensitive, touchscreen, touchpad; press, push, force; var, differ, threshold, hard, degree

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/15132 A (DEEP VIDEO IMAGING LIMITED) 1 March 2001 Whole document	1-15
X	WO 01/09664 A (DEEP VIDEO IMAGING LIMITED) 8 February 2001 Page 9, Figure 1	1-10, 12-15
A	JP 10-198507 A (KOMOTA KK) 31 July 1998 (Abstract and translation from www1.ipdl.jpo.go.jp/PA1/cgi-bin/PA1INDEX) Paragraph 10	1, 7-8

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 June 2002	28 JUN 2002
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	MICHAEL HALL Telephone No : (02) 6283 2474

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT	International application No. PCT/NZ02/00059

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5241308 A (YOUNG) 31 August 1993 Columns 3, 7	1, 7-8
A	Derwent Abstract Accession No. 89-212235/29, Classes T01, T04, RD 302089 A (ANONYMOUS) 10 June 1989. Abstract	1, 7-8

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/NZ02/00059

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
WO	01/15132	EP	1212745		
WO	01/09664	AU	63265/00	EP	1204894
JP	10-198507	NONE			
US	5241308	NONE			

END OF ANNEX